Qualcomm Presence with Unifying Signals API Project

Bi-Weekly Report

24th October 2014

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Project progression

These two last weeks we have continued doing research on devices that could be used to cover the doors exits. The research papers are attached to this document as well as the client meetings report. We have now done quite a lot of research on presence detecting and as we have noticed they are so many solutions. For the moment we really want to start testing different devices therefor for an easy start we will be using: Ir Infrared Range Sensor that should be connected to an arduino and a kinect camera. We believe that ounce we have manage to control and interact with one type of sensors it will be easy to go and test with others.

Project solution at the moment:

A designed system on top of each doors counts people coming in and out.
Each time a presence is detected it sends a signal to the other group.
In the middle of the room another device tries to double check the data calculated by the doors.

Tasks completed:

- 2 follow up skypes with our clients

- we created a schedule of task we had to do
- 3 Meetings with the other group.
- In depth research on different devices
- Setting up a drive to unify the data collected
- Meeting up with 2 different supervisors
- Ordering of sensors: kinect,

Tasks to do in the coming week:

- If we have received the devices starting to interact with them
- Coming up with another way of verifying how many people are in a room to double check the in and out system. Example: wifi connection, noise detection…
- Starting to think with the other group on a way to send the data collected for global processing.

Meeting records

Date & Time: 13/10/2014 , 10:00

Place: Engineering Cafe, Malet Place Engineering Building

1. Apologies

Everyone present.

2. Minutes from the last meeting

- Research on different sensors
- Having a first on paper layout of how our system is going to function, with the names of all the elements in it.

3. Discussion

- Prepare client meeting
- Further research on people counter system
- Organise a meeting with the UCL technical advisor

4. Task allocation

Whole team:

- Research on people counter system

Date & Time: 14/10/2014 , 14:00

Place: Malet Place Engineering Building 1.21

1. Apologies

Everyone present.

2. Minutes from the last meeting

- Prepare client meeting
- Further research on people counter system
- Organise a meeting with the UCL technical advisor

3. Discussion

- continue to research on sensors and algorithms to use sensors
- Organise a meeting with the UCL technical advisor

4. Task allocation

Laszlo

- Research and make documentation on IR, PIR, Ultrasonic and Kinect sensor.

Yichen

- Research and make documentation on IR, PIR, Ultrasonic and Kinect sensor.

Soo Yong

- Research and make documentation on thermopile sensor

Date & Time: 20/10/2014 , 10:00

Place: Engineering Cafe, Malet Place Engineering Building

1. Apologies

Everyone present.

2. Minutes from the last meeting

- continue to research on sensors and algorithms to use sensors
- Organise a meeting with the UCL technical advisor

3. Discussion

- continue to research on sensors and algorithms to use sensors

- Organise a meeting with the UCL technical advisor
- research on how to connect devices to transmit data (Every device has to have the same protocol, possibly AllJoyn)

4. Task allocation

Whole team

- start to document how to process data from readings from different sensors
- research algorithms for each sensors

Date & Time: 21/10/2014 , 14:00

Place: Malet Place Engineering Building 1.21

1. Apologies

Everyone present.

2. Minutes from the last meeting

- continue to research on sensors and algorithms to use sensors
- Organise a meeting with the UCL technical advisor
- research on how to connect devices to transmit data (Every device has to have the same protocol, possibly AllJoyn)

3. Discussion

- continue to research on sensors and algorithms to use sensors
- how to transform analogue signals to digital values (binary/boolean value)
- how to write a robust solution program (how do we error correct?)

4. Task allocation

Laszlo

- Research and make documentation on device detection (WIFI / Gimbal)

Yichen

- Research and make documentation on thermopile sensor

Soo Yong

- Research and make documentation on Kinect sensor

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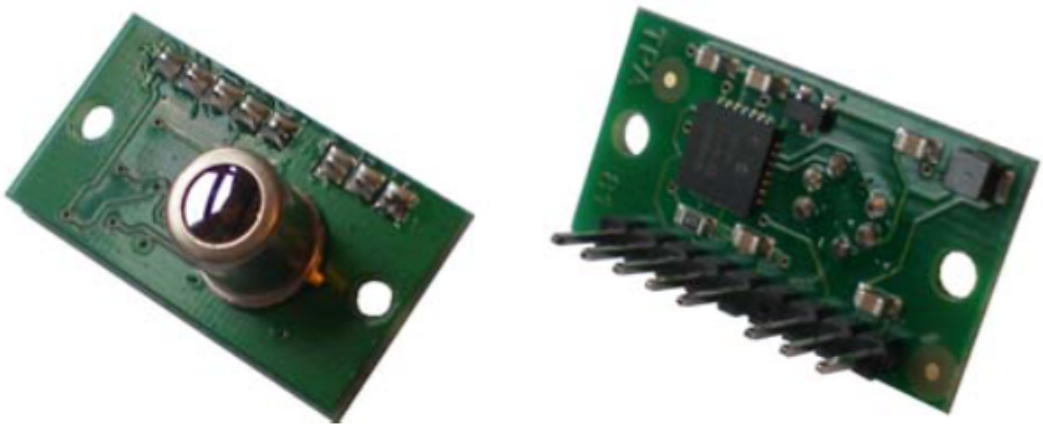
Work packages Schedule until 12/12/2014

Task	Status	Comments	Date (Week start date)										
			29/09	06/10	13/10	20/10	27/10	03/11	10/11	17/11	24/11	01/12	08/12
Requirements	**In Progress**	**Deadline 13/10**											
Background research and requirements analysis	**Complete**	**Deadline 06/10**											
Initial internal group meeting	**Complete**	**Deadline 06/10**											
Inaugural client meeting	**Complete**	**Deadline 06/10**											
Meeting with UCL technical supervisor	**In Progress**	**Deadline 13/10**											
Research on different presence detection systems	**Complete**	**Deadline 13/10**											
Design	**In Progress**	**Deadline 20/10**											
Obtain required hardware devices	**In Progress**	**Deadline 20/10**											
Design prototype system based on requirements	**In Progress**	**Full theoretical system working / Deadline 20/10**											
Implementation	**Pending**	**Deadline 01/12**											
Build working prototype system	**Pending**	**Build first working prototype/ Deadline 08/12**											
Build project demonstration website	**Pending**	**Deadline 08/12**											
Project demonstration video	**Pending**	**Deadline 08/12**											

Thermopile array sensor

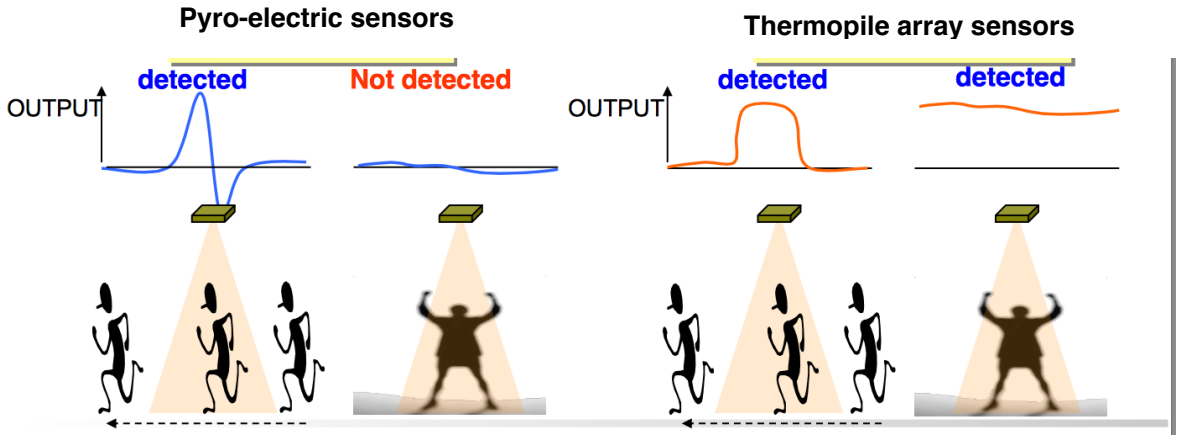


(a) frontal view (b) rear view

Description : Thermopiles are stacks of junctions of two different material, which produce a voltage proportional to the temperature difference at the junction. If a heat absorber is adequately connected to one side of the junction, thermopiles provide an effective contactless method for measuring the temperature of objects.

Advantages: -

- thermopiles are passive sensors, which means they do not require to radiate energy to the environment as a laser range finder, and therefore, are not affected by the reflectivity of the materials and are undetectable.
- thermopiles measure heat, i.e. infrared radiation, in the 2 – 20 μm, and thus are not affected by changes in the scene illumination as regular vision-based methods.
- unlike pyro-electric sensors(such as PIR sensors), whose output is proportional to the rate of change of the object's temperature, the output of thermopiles is proportional to the difference between the object and the ambient temperature. Therefore thermopiles does not require the source is moving.



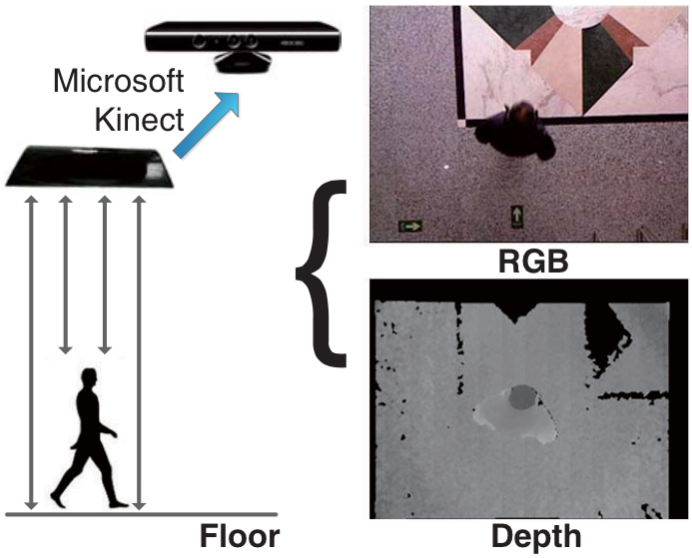
Kinect sensor

Advantages : -

- Kinect sensor gives the calibrated depth information of every pixel and this information is illumination, colour and texture invariant.
- the depth image has smaller noise and is more stable in Kinect than in stereoscopic camera.
- the Kinect use the infrared camera, so it doesn't affect too much in the ambient light variable problem

Since the heads are always closer to the camera than other part of the body in the view of vertical Kinect sensor, detecting people's head equals to finding the suitable local minimum regions in the depth image.

Process :



1. do the morphological processing to the depth image of Kinect
2. find the target's local minimum region in the depth image (people's head)
3. determine and calculate the targets found from the local minimum region whether they are in occlusion or not
4. Then we can count the number of pedestrian

There are two ways to connect sensors and get readings.
The first one is using Arduino,

Distance Sensing

NewPing - Fast Arduino library for the HC-SR04, SRF05, SRF06, Parallax PING))), DYP-ME007 & URM37 ultrasonic distance sensors.
Arduino library for various distance sensors
http://www.arduino.cc/en/Tutorial/UltrasoundSensor - I just wanted to point out that this code also works for the Maxbotix Max Sonar ultrasonic range finder... which is sold in the USA through SparkFun Electronics...
MaxBotix/MaxSonar tutorial: I have found the above PING code doesn't work with MaxSonar devices so I did a small writeup.
Parallax Ping - code http://playground.arduino.cc/Main/UltrasonicSensor - Variant of the code above but returns actual distance.
GP2D12 infrared sensor - read_gp2d12_range is a function that retrieves distance from this sensor in centimeters.
Simple IR distance sensor using a Panasonic IR sensor and IR led using the IR sensor and led from the boe bot kit. http://playground.arduino.cc/Main/PanasonicIrSensor
URM37 Ultrasonic Distance Measurement Library. URM37 Ultrasonic Distance Measurement Library by Miles Burton
SRF08 Ultra Sonic Range Finder Code - http://playground.arduino.cc/Main/Sonar_srf08 Communicate with old SRF08 sensor via Wire.h protocol. Choose inch or centimeters and change address.
SRF02 Ultra Sonic Range Finder Library - http://www.grappendorf.net/arduino-atmel-avr/arduino-libraries/srf02-ultrasonic-distance-sensor Communicates via the I2C protocol and supports multiple sensors.
SRF04 Ultra Sonic Range Finder Library - http://code.google.com/p/srf04-library/ - Analog ultrasonic distance sensor.
Sharp GP2Y0A21YK IR Distance sensor Library - http://code.google.com/p/gp2y0a21yk-library/ - Analog IR distance sensor.
Interfacing Arduino with a digital caliper - a short tutorial which explains how you can interface Arduino with a cheap digital caliper.

Above is all the distance sensors that could be used in our project.

The second way is using Raspberry Pi,

Here is a tutorial about connecting the temperature to raspberry Pi, https://www.cl.cam.ac.uk/projects/raspberrypi/tutorials/temperature/ , we just need to replace the thermal sensor with a distance sensor and we are able to get data from python or terminal window.

And we can just use **Sharp GP2D12** for raspberry Pi just like they used in robot last year.